Ulysses/IMP8 Observations Of Solar Wind Temperatures And Anisotropies in the Ecliptic From 1 To 5.4 Au and Out of the Ecliptic

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Measurements are reported of the radial and latitudinal gradients of Ulysses solar wind proton parameters. Observations include the in-ecliptic results for radial distances from 1 to 5.4 AU, and out of the ecliptic measurements. Observed solar wind events are categorized (Trailing edge of high speed streams, Coronal Mass Ejections, etc.), and radial gradients of plasma parameters are presented for these different types of regions, For all Ulysses solar wind proton data taken together, the power law dependence of $T^{1.5}/n$ (an adiabatic "invariant", where T is temperature and n is number density) upon distance is $r^{1.04}$. For trailing edges of high speed streams, the power law dependence is $r^{0.85}$. Estimates of the entropy dependence have also been made by comparing Ulysses data to IMP 8 data with allowance for radial and corotational delays, and only using data for which the velocities at the two spacecraft are in reasonable agreement, The comparison data set indicates a dependence of $r^{1.17}$; the comparison data set restricted to trailing edges has a $r^{1.35}$ dependence. As trailing edges are heated as much with increasing radial distance as the solar wind as a whole, and the trailing edge plasma has not been shocked, solar wind heating must be dominated by other sources (e.g. wave dissipation). Latitudinal gradients have also been investigated. The average solar wind velocity increases to 750 km/see at 450 latitude, and the average mass flux/ster at 45^{o} is reduced by 35% from the value observed in the equatorial plane. At high latitudes, the solar wind flow resembles flow from coronal holes as seen in the equatorial plane, Among the features of interest are suprathermal tails on the proton distributions at high latitudes, and T-parallel/T-perpendicular> 1 for the higher energy protons. Distance from the current sheet as determined by the Stanford magnetic source surface data does not appear to organize the data significantly better than distance from the heliospheric equator.

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